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12

EFFECT OF FOAM DRAINAGE VESSEL VARIABLES

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Various types of vessels have been used to determine the drainage rate of forest fire suppression foams without considering the effects of foam column height and vessel diameter on data estimates. A special drainage vessel was designed and manufactured for use by Petawawa National Forestry Institute researchers to minimize data variation, but other researchers typically use graduated cylinders of various types and sizes. Laboratory trials were initiated to identify the impact of foam column height and vessel diameter using four 40 cm high vessels (built in-house) with inside diameters of 3.1, 5.0, 6.5, and 8.9 cm (vessel numbers V1 to V4 respectively).

The blender (1.8 L capacity) generated a reproducible type of foam, but the capacity of the 8.9 cm vessel exceeded the blender's output, so foam generated by the laboratory's compressed air system was used. Drainage was determined for incremental foam depths of 10, 20, 30, and 40 cm using compressed air foam and for 10 cm depth for blender-generated foam. SILV-EX solutions, mixed at 0.5%, were used in all cases. The percentage drainage was plotted at 2 min intervals, but for the purposes of this analysis, lapsed times of 5, 15, and 25 min were used to verify trend consistency.

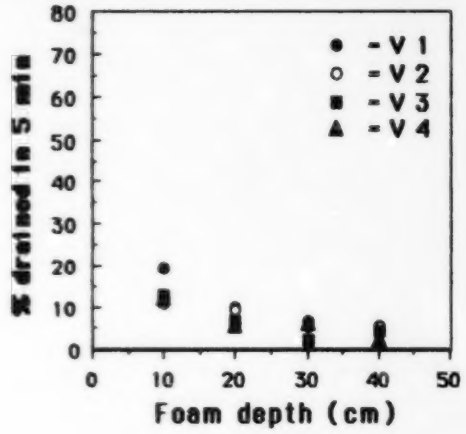

Figure 1. Percentage drainage at 5 min.

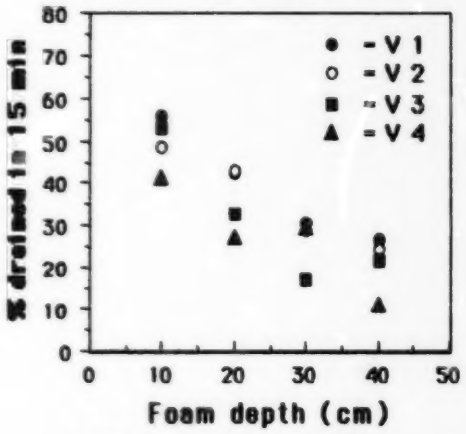

Figure 2. Percentage drainage at 15 min.

Vessel Diameter

Plots for the blender foams, foam height of 10 cm (Fig. 1), do not indicate any pattern based on vessel diameter or foam expansion. Unlike diameter differences, expansion variations were not sufficiently large to have any major impact. In Figures 2, 3, and 4, for compressed air laboratory foam, this inconsistency of point scatter was evident for all four foam heights. The mix of point positions indicated that the breakdown rate was mainly controlled by the inherent characteristics of the foam and not by the cross-sectional area of the foam's surface. The degree of point scatter increased as time increased. Although expansion of the compressed air laboratory foams ranged from

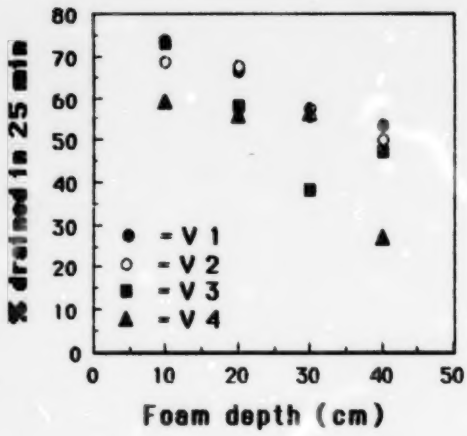

Figure 3. Percentage drainage at 25 min.

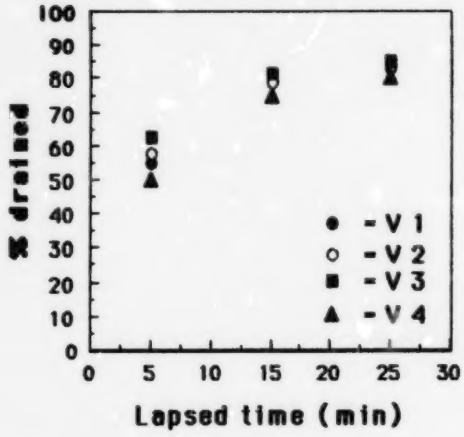

Figure 4. Percentage drainage over time.

3.7X to 5.6X, there was no evidence to indicate that expansion influenced the vessel point positions.

Depth of Foam

Drainage is the process whereby the free solution filling the voids between the bubbles and the solution released due to bubble breakdown sets up a flow pattern throughout the entire depth of foam,

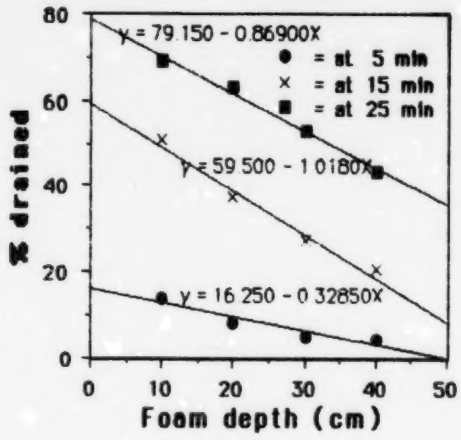

Figure 5. A plot of the mean values for each of the four foam depths and linear equations for each set of data.

coming to rest at the bottom of the column. The rate at which the solution accumulates at the bottom is governed by the pathway distance. Because vessel diameter did not clearly impact on the rate of drainage, the data for all vessels for each foam depth were averaged and plotted (Fig. 5). A practical method for comparing rates is to develop $Y = a + bX$ type equations. In this particular case (SILV-EX @ 0.5% mix), the equation $Y = 59.5 - 1.0X$ could be used to correct for depth differences at a lapsed time of 15 min.

Recommendations

Foam quality checks should always be conducted using the same depth of foam, otherwise a correction equation should be derived and applied to bring all data to the same reference plane. Furthermore, comparisons of data from different sources should not be made without some knowledge of how these data were collected and the degree of adjustment required.

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